# Trauma Rounds

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# Organization of Emergency Medical Services

F. WILLIAM BLAISDELL, MD:* In the past ten years, organized medicine has been confronted with a remarkable phenomenon—the rapid proliferation of emergency medical services throughout the United States. Until 10 or 15 years ago, there was but one full-time emergency facility in San Francisco while at present 14 of the 18 hospitals in the city have 24-hour emergency rooms manned by full-time physicians.

This radical change has not been brought about by an epidemic of emergencies. Although there has been a trend toward more violence-related emergencies, the total number of emergencies in San Francisco has not changed appreciably over the past 10 to 15 years.

The reasons for this dramatic change appear to relate primarily to two factors. The first of these is a change in attitude by both patients and physicians; all seem to be moving toward the hospital as the basis for both inpatient and outpatient medical care. The reason for this, in turn, relates to the fact that physicians are working shorter hours and consequently may not be available to their private patients when the need for medical care (which is often crisis-related) develops. In addition, with a progressive increase in specialization in medicine, the patient's own physician, even if available, may not be capable of dealing effectively with his patient's particular problem. Most important, a well-equipped hospital is capable of providing a wide range of sophisticated diagnostic and therapeutic services.

The second major reason for the nationwide trend toward proliferation of emergency medical services relates to economic factors in our free enterprise society. Before the Medicaid and Medicare programs were instituted in 1966, a patient who presented to the hospital for crisis care was most commonly a nonpaying one or one who, when capable of paying for emergency care, frequently nonetheless did not. But with the advent of federal and state health insurance programs, most patients became eligible for third-party payment, the rising cost of emergency care could be passed on to a third-party payer while the patient himself remained only vaguely aware of the actual skyrocketing costs of these expensive services. Increased utilization of emergency rooms therefore permitted billing at premium rates for care of illnesses that were formerly managed much less expensively in doctors' offices and it became possible to hire emergency room physicians at salaries averaging $60,000 per year because of the

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premium rates charged for delivery of these "emergency" services. Furthermore, hospitals encouraged the use of emergency rooms for primary care because it generated greater utilization of their diagnostic services and promised to fill empty hospital beds. As a result of these forces and motivations, every hospital has been allowed to develop whatever services it wished without regard to whether such services were actually needed in its particular community.

But most recently, increased consumer awareness is developing regarding the implications of this trend, in terms of health care costs. The passage of the Cranston Act, the activities of the Department of Health, Education, and Welfare, and the development of Health Service Agencies have all pointed out loudly and clearly that this situation will not be tolerated by the public indefinitely. It seems evident that if the health profession is not capable of improving its organization, the consumer will institute measures to do so.

Our symposium today is designed to discuss some of the concepts being developed in relation to emergency medicine and to outline the benefits of organizing such services, including improved cost effectiveness.

I have asked Dr. Robert Allen to discuss prehospital aspects of the emergency medical care system.

ROBERT ALLEN, MD:* The basic philosophy regarding emergency medical care has changed drastically over the past several years. The idea that emergency medical care started and stopped in the emergency department of a hospital has given way to the much broader concept that emergency care should be extended out from the hospital to the ill and injured in the field.

This prehospital component of the emergency care system is theoretically as important as the hospital-based care if further major impact is to be made in improving survival rates and in decreasing disability secondary to emergency injuries and illnesses. Therefore, it is essential that the operational design of the emergency care system be such that orderly and logical functioning of the various components is ensured.

The increased nationwide interest in extending emergency medical care received its initial impetus from President Nixon when, in the State of the Union Message of January 20, 1972, he stated "I am directing the Department of Health, Education, and Welfare to develop new ways of organizing emergency medical services. . . . Today it often seems that our service programs are unresponsive to recipients' needs and wasteful of the taxpayer's money. A major reason is their extreme fragmentation."

As a result of this expressed interest by the President, directives were sent to the Department of Health, Education, and Welfare to develop a means for encouraging consolidation of emergency services. The concepts of regionalization and categorization of services were developed and their implementation made possible by Senator Alan Cranston who initiated legislation—the Cranston Act, Public Law 93-154—passed by Congress in 1973. However, recognition of the need for improved and advanced emergency medical care had germinated and was growing long before President Nixon took this initiative. During the Vietnam conflict, the rapid transport of victims from the front lines by helicopter to base hospitals which could provide comprehensive emergency services and definitive care—bypassing field hospitals—resulted in such a low mortality rate from serious injury that it has yet to be duplicated in civilian practice. In recent years, new techniques such as cardiopulmonary resuscitation and the technology of biotelemetry have been developed which have permitted skills in the resuscitation of critical emergency victims to be extended to the field. These new concepts were first applied to the emergency care system in Belfast, Ireland, by J. F. Pantridge and involved the prompt administration of advanced life-support techniques to heart attack victims at the site of cardiac arrest. As a result, since that time a major campaign has been mounted toward reducing prehospital deaths due to coronary artery disease.

Major considerations to be made in developing an emergency medical care system are those relating to the demography, geography and traditions of a particular region. The offices of Emergency Medical Services of the Department of Health, Education, and Welfare have made a continuous effort to standardize emergency care nationwide, an idea that is courageous and laudable. However, an emergency care system must assume responsibility for unique local needs of its citizens in addition to fulfilling fundamental criteria for delivery of quality emergency care. Any given system should also be cost effective and affordable. But before too much emphasis is placed on afforda-

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bility, it must be determined how much a human life is worth.

Problems encountered in relation to developing rural emergency medical care systems are quite different from those encountered in metropolitan areas. In rural areas, the primary problem relates to attempts at promptly entering the emergency care system and at shortening its response times. In contrast, in metropolitan areas where there is the potential for rapid entry into the emergency health care system, the primary problem is how to deliver prompt, definitive hospital care once a patient arrives in an emergency department. In the latter instance, categorization of hospital capability then becomes the key factor in developing quality health care delivery.

In 1972 San Francisco, through the city's Department of Health, upgraded its emergency medical care system primarily by instituting training programs for its personnel and by developing a sophisticated communications system. The triage pattern within the City and County of San Francisco had formerly been set by tradition; for the past 80 years, all patients who were seriously ill or injured were automatically taken to San Francisco General Hospital. But after all activities of the emergency care system in the prehospital phase were analyzed, it was found that 63 percent of this activity was trauma-related while the remainder consisted of treating miscellaneous lesser "emergencies." Traumatology training was therefore given priority. Each ambulance attendant was trained to the advanced life-support level and each ambulance driver to the basic life-support level. In addition, a system of first responders through the Fire Department was instituted to cut down on response times. To date, we do not as yet have adequate data to document the degree to which this new system actually has improved salvage rates and reduced morbidity over that of the old system. But we believe that the effectiveness of the health care system has been extended into the prehospital areas by this new system's approach. Training paramedic personnel, improved communications and transportation of victims with treatment initiated en route utilizing telemetry control from a physician in a base station have vastly improved the efficiency of our emergency medical care system.

DR. BLAISDELL: I would like to ask Dr. Donald Trunkey to comment about whether or not trauma centers are effective.

DONALD D. TRUNKEY, MD:* There are several factors that determine whether or not trauma centers are effective.

*First,* trauma centers are extremely costly; hence, there must be a demonstrated need for them. We recently published data in the *Journal of the American College of Emergency Physicians*[1] showing that California had need for somewhere between 12 and 16 trauma centers or trauma programs, based on the total number of emergency injuries treated annually and on geographical considerations. I believe Dr. Teufel will enlarge upon the issue of costs of trauma programs in his presentation.

The *second* factor concerns the actual provision or quality of emergency care. There is no question that over the past ten years there has been considerable improvement in techniques used to resuscitate trauma victims, particularly those used by paramedics in the field. Ideally, with the delivery of a patient to an emergency room, this resuscitation effort is continued and augmented. Resuscitation by itself will not guarantee salvage of the victim. This will be dependent on definitive care. But the problem is that of the 542 acute care hospitals in California, 419 have 24-hour emergency rooms. Most of these facilities are capable of initial resuscitation but they do not have prompt definitive care capability; that is, they are not able to provide such services as immediate operation for control of internal hemorrhage.

The public is very confused about the implications of this latter factor; that is, resuscitation capability versus definitive care capability. They simply do not know what is available based on what the hospital sign says. Fully equipped trauma centers can provide 24-hour definitive care by in-house staff while emergency rooms can provide resuscitation but may or may not be able to provide prompt, definitive care. Hospitals must provide specific capabilities and the public must be made aware of what they are.

My colleagues and I have been concerned about this discrepancy between resuscitation and definitive care capabilities. Consequently, in 1974 we reviewed an autopsy series in San Francisco County where victims of most injuries are transported to only one trauma center. The results of this study, which were also published in the *Journal of the American College of Emergency*

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*Physicians,*[2] showed that the presence or absence of prompt, definitive care capability was indeed a factor in determining ultimate outcome. In essence, it was shown that unnecessary or preventable deaths accounted for only 3 percent of all mortality in a hospital with 24-hour trauma capability, while in hospitals where services were not immediately available, this mortality rate could rise to as high as 66 percent.

However, this study could be criticized since it was confined to a single geographical area. But its results are nonetheless supported by similar studies done in Baltimore[3] and in the state of Texas.[4] Based on the results of our study and of these latter two in Baltimore and Texas, Dr. John West, a member of the American College of Surgeons' Committee on Trauma (Southern California Chapter), conducted a similar study comparing mortality in his county with that in San Francisco County.[5] Summarizing the results, an analysis of 100 consecutive trauma deaths in each county showed that most of the deaths in San Francisco County were due to neurological causes. Of its 15 nonneurological deaths, only one was considered possibly preventable. In contrast, in the Southern California county 31 of the total number of deaths were due to hemorrhage; of these, 21 were considered preventable in that the patients received operations late (if at all) and had relatively simple injuries such as ruptures of the spleen, lacerations of the liver and lacerations of the mesentery. We believe patients with these types of injuries should be salvageable more or less routinely by a sophisticated, well-organized system.

While this study supports the concept that trauma centers are effective, it does not address the problem of need for such centers. Actual need for trauma centers is arrived at only as a result of knowing the incidence of trauma within the various geographical regions that the center(s) would serve. We do think, however, that this last study does lend credence to the belief that the ability to administer definitive care promptly is the most important factor. This does not entail transporting trauma victims to the nearest hospital. In fact, with modern transportation and with the available expertise of paramedics, it is far better to transport victims to hospitals with 24-hour definitive care capability. I also feel strongly that it should be surgeons who set the guidelines for how many trauma centers or trauma programs are needed and that we should not abrogate this responsibility to other health care professionals or health planners who do not have the experience with treatment of trauma patients that we have.

DR. BLAISDELL: Dr. William Teufel has done an extensive study of emergency medical services and has made recommendations as to how trauma centers can be developed that meet the needs of the population, yet also are cost effective. Results of this study were published in the December 1977 issue of the *Journal of the American College of Emergency Physicians.*[1]

WILLIAM L. TEUFEL, MD:* I will review briefly some aspects of trauma center development that Dr. Donald D. Trunkey and I recently outlined in a paper presented at the University Association for Emergency Medicine's annual meeting in Kansas City, Missouri, in May 1977.

In recent years, national and state governments and organized medicine have attempted to define the optimal trauma center.[6,7] While they have developed some definitive guidelines, they have not adequately addressed three major factors, the consideration of which is essential for effective planning of trauma centers: realistic staffing patterns, costs associated with such staffing and criteria for determining the actual need for such trauma centers.

If one reviews the guidelines for an optimal trauma center as published by the American College of Surgeons' (ACS) Committee on Trauma and the Health Services Administration[6,8] and then applies recent salary figures (from a survey published in *Medical Economics,* April 1975), the yearly staffing costs for such trauma centers are easily calculated. One finds that the ACS optimal trauma center would cost $3,679,440 and that a center such as proposed by the Health Services Administration would cost $2,692,790.

Additionally, as extensive as these lists may appear, neither includes first and second surgical assistants who are often required for adequate operative intervention in relation to multiply injured trauma victims. Also, neither of these plans addresses the problem of backing up the initial trauma team once one patient enters the operating suite.

At present, only a few large university teaching hospitals actually approach these staffing patterns and they use residents as surrogates to maintain 24-hour coverage, with a corresponding reduction in staffing costs. It is obvious that without major

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TABLE 1.—*Community Hospital Trauma Program Physician Staffing Pattern*

| | |
|---|---|
| In-House 24 hours a day | |
| Five Minute Availability | |
| Emergency physician | 1 |
| General surgeon | 1 |
| Anesthesiologist | 1 |
| Promptly On-Call 24 hours a day | |
| 15 to 30 Minute Availability | |
| Orthopedist | 1* |
| Neurosurgeon | 1* |
| Internist | 1 |
| Radiologist | 1 |

*Expected to function as first surgical assistant to general surgeon, if needed.

modifications, such trauma center staffing patterns are impossible for a community hospital to fulfill, since they have little or no house staff available.

In order to develop practical standards for an alternate "optimal" unit for a community hospital, we have arbitrarily designated the ACS optimal categorization as a "trauma center." Our proposal for a community hospital, designated a "trauma program," includes attainable staffing patterns with maintenance of quality medical care.

## Community Hospital Trauma Program Staffing Pattern

In many of the suburban and rural areas of our country, a number of community hospitals without house staff provide care for trauma victims. These emergency departments are covered, to an ever increasing extent, by contracted groups of full-time emergency physicians with varying degrees of training. Many of these hospitals have some type of in-house anesthesia coverage but very few have either a surgeon or an operating room crew after daytime hours. However, most of such hospitals have on-call general surgeons, orthopedic surgeons, internists, radiologists and, to a lesser degree, neurosurgeons.

In our pattern for using such physician resources (Table 1), the in-house team consists of one general surgeon, one anesthesiologist and one emergency physician. We feel this is the minimum number of physicians needed to rapidly resuscitate a critically ill or injured trauma victim and to secure temporary operative control of hemorrhage. This proposal does provide critical in-house surgical coverage. We believe that many community hospitals are capable of meeting this in-house staffing pattern, even with limited manpower.

In addition, community hospital trauma programs must have physicians in the following surgical subspecialties on call within 30 minutes: thoracic surgery, urology, obstetrics and gynecology, ophthalmology, otolaryngology, and plastic surgery.

Prompt availablity of on-call physicians (Table 1) is crucial to the effective operation of the trauma program. The orthopedist, neurosurgeon, internist and radiologist are the four specialists most frequently called to support the general surgeon and his resuscitation team. The success of this plan is also based on the fact that the neurosurgeon or orthopedist will act as the first surgical assistant to the general surgeon when operative intervention must be immediate and when time does not permit contacting another surgeon. This role will be either new or uncomfortable for many practicing orthopedists and neurosurgeons. However, often a multiply injured trauma victim needs the combined services of a general surgeon, neurosurgeon and orthopedist, so the orthopedist and neurosurgeon would need to be present regardless.

Essential to this staffing pattern is a paid, part-time program director, appointed by the medical staff, who will be responsible for coordinating various aspects of the program in addition to supervising the in-house care provided in the intensive care unit. The director would also be responsible for assuring that the persons involved in the program are adequately trained and able to function as a surgical team on all occasions. We also recommend that a paid coordinator of nursing and allied health personnel be responsible for all nonphysician aspects of the in-hospital trauma program.

When one adds all the physician, nursing and allied health personnel costs we feel are necessary to staff such a community hospital trauma center, one arrives at an estimated annual cost of $1,682,-336 for such a program. We would estimate such a community hospital trauma program would need 400 to 500 trauma admissions per year in order to maintain skills.

It is apparent that whatever the trauma center or trauma program, the costs are high. Consumers cannot afford to pay for unnecessary trauma centers any more than they can afford to pay for unnecessary burn or neonatal care centers. How then does one estimate the need for trauma center development? Our review of the literature shows no clear discussion or guidelines to determine need. At least two states, Illinois and Maryland, have approached trauma care statewide; however, it is unclear if actual needs were determined in these

states; if so, how they were determined is also unclear. R. M. Gurfield, in a recent article in the *Journal of the American College of Emergency Physicians*,[9] delineated several indicators of need with respect to general emergency medical services, one of which was injury-producing automobile accidents. Serious motor vehicle accidents appear to be a stable forecaster, as they are the major source of multiple injuries in this country, with the exception of traumatic injuries such as gunshot and stab wounds in a few large urban areas. Using California as an example, we have developed what we believe to be a relatively simple and useful method for determining statewide need for trauma facilities.

Based on our review of data collected by the California Highway Patrol (CHP),[10] it would appear that each motor vehicle fatality results in an average of one patient requiring specialized trauma care, and that approximately 5 percent of all injured motor vehicle accident victims will require similar specialized trauma center care.[11] It is then a rather simple matter to take the readily available annual county-by-county CHP reports for motor vehicle accident victims who are killed or injured and multiply these figures by the aforementioned percentages to arrive at an indicator number for each county in the state.

From a purely mathematical standpoint, California can support 16 trauma centers or programs, each seeing no less than 1,000 seriously injured victims per year—the number recommended by the American College of Surgeons.

However, the obvious next step is to apply these mathematical indicators to known geographic and political boundaries. When this is done for California, it appears that the state could quite easily support 12 trauma centers or programs. It is also apparent that the population near the northern boundary of the state—around the Tahoe basin and in the eastern desert region—is best served by potential centers in Medford, Oregon, and in Reno, and Las Vegas, Nevada, respectively.

As stated previously, this scheme deals only with motor vehicle accidents. In large urban areas such as San Francisco and Los Angeles, the percentage of the trauma case load generated by sources other than motor vehicle accidents would need to be reviewed. Based on our experience, it is likely that these additional cases would not necessitate any increase in the number of trauma centers in either the two largest urban areas in California, simply because the comprehensive trauma centers in these areas will be able to handle case loads well in excess of 1,000 admissions per year.

We have attempted to deal rather pragmatically with some of the very real problems impeding the planning and development of regional trauma care centers. However, this presentation would be incomplete if mention were not made of the major impediment to such planning: regional and hospital politics. Each hospital wishes to see itself as a full-service institution fully capable of taking care of any and all problems. Most experienced emergency physicians feel that they can resuscitate almost any critically injured patient in their home hospitals. Most well-trained surgeons also feel that they are capable of treating such problems. Taking into account these factors plus the increasing number of unutilized hospital beds, there is little wonder that one becomes discouraged about the prospects for getting hospital administrators, emergency physicians and surgeons to work together and concentrate on giving optimal care to critically injured patients.

As awesome as the estimated staffing costs presented are, they are predicated on salary scales that are now five years old. Consequently, anyone planning to develop such trauma centers should expect to pay 10 percent to 20 percent more. We hope our presentation of a community hospital trauma program staffing pattern will precipitate some planning and critical thinking by those in areas of our country where large teaching hospital trauma programs are not available. But development of such trauma programs should not be undertaken without considering the factors discussed in relation to need. Only after determining actual need and applying a little common sense should one even begin preliminary planning for a trauma center.

DR. BLAISDELL: On the basis of all this information, it should be evident that organization of emergency services is urgently needed, with available emergency resources being concentrated in fewer hospitals for greater utilization and efficiency. An example of the type of planning that should be undertaken statewide is the emergency system plan we are now proposing for the City and County of San Francisco. In this proposal we have recommended that the public ambulance system, which heretofore has only transported patients to public hospitals, should be utilized to transport private patients to private hospitals as well, provided the

patient's physician is available or the receiving hospital has basic emergency room capabilities. However, if the transported patient's condition is unstable, we propose that he be transported to a district hospital. Although there are presently 18 hospitals in San Francisco, the total recommended number of hospitals to be designated as "district hospitals" is only three.

The requirements for such a district hospital would be the following.

- That it be capable of providing broad-spectrum emergency care—that is, that it can immediately and definitively treat major emergencies of every general type including neurosurgical, medical, pediatric, obstetrical and psychiatric, as well as trauma.
- That it have developed major emergency room capability as defined by the State of California Emergency Medical Plan.
- That it maintain an uncommitted operating room which is immediately available for any and all emergencies 24 hours a day.
- That it provide 24-hour laboratory and x-ray services, including the necessary in-house personnel to staff them.
- That it provide emergency staff privileges for any qualified physician in the region and allow him to assume responsibility for the management of his patients who are brought to the district hospital, provided he possesses the expertise to do so.
- That standard statistical records be kept and that these records documenting performance be made available to a regional director of emergency services and to the county Emergency Medical Care Committee for evaluation and review.
- That continued designation as a district hospital be contingent upon successful delivery of services comparable in quality to those delivered by the other district hospitals.

We further recommend that there be only one telemetry base station for the city of San Francisco. This conclusion is based on Department of Health, Education, and Welfare requirements which specify that there should be no more than *one* such base station for a population of one million. However, all receiving hospitals should be allowed to use the system to monitor and receive telemetry data on patients being transferred to their respective facilities.

We have also recommended that regionalization of emergency facilities be instituted, as recommended by the Department of Health, Education, and Welfare. This would entail consolidation of emergency services for Marin, San Francisco and San Mateo counties because they constitute a Health Service Area (HSA 4). The overall emergency care capabilities of the three counties should be reviewed as a whole and the need for cardiac centers, burn centers, trauma centers and drug information centers be assessed accordingly. Transfer and referral agreements among all the hospitals in these three counties should be developed to permit optimal utilization of the sophisticated facilities available in these metropolitan areas.

I feel very strongly that the medical profession should encourage measures such as these and should initiate them when and where we are able. If we do not, it will ultimately be done for us—and perhaps in a manner that our profession will not find either palatable or medically appropriate.

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